

A Systematic Review on the Paradigm Shift in Neuroentrepreneurship Education Across Developing Asian Countries: Visualization and Analysis

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Abstract

The psychology of entrepreneurship focuses on the traits entrepreneurs demonstrate that motivate them and ultimately contribute to their success. Further, recent advancements in neuroscience facilitate a captivating new lens through which to understand entrepreneurial cognition and behavior. Such understanding helps business incubators and educationalists to move away from the “about” or “for” approach to the “through” approach of neuroscientific technique in entrepreneurial education as a pragmatic approach. Research on neuroentrepreneurship is fragmented, and a thorough and compressive literature review is missing. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework was adopted to build a knowledge map using the VOS network map and wondershare EdrawMind to develop a framework for neuroentrepreneurial education. A total of 161 eligible articles were initially critically reviewed and investigated using the Ryyan tool, and later, 15 articles were selected for in-depth review focusing on neuroentrepreneurship. The results revealed that developing countries are still lagging in the revolution of entrepreneurship while not captivating the neuroscientific techniques with experimental applications. Since the brain correlates with entrepreneurial behavior and mindset, the study reveals that incorporating neuroscientific techniques from the schooling level is stressed. Moreover, it highlights how experiments and neuroscientific techniques contribute to improving entrepreneurial theories. Neuroentrepreneurship as a workable strategy derives a paradigm shift in entrepreneurship education for developing a holistic entrepreneurial mindset in Asian nations. The further study investigates the behavioral experimental application to investigate brain and psychology behaviors using control tasks (BART risk-taking game) and transcranial magnetic stimulations (TMS). Based on the reviews of available literature, this study proposes a neuroentrepreneurship education framework, serving as a groundwork for further research to develop more research in this area and to practically implement this distinctive conceptualization.

Keywords: *Cognitive neuroscience, Entrepreneurial Behaviors & Mindset, Neuroentrepreneurship Education, PRISMA Review*

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Background and Introduction

Entrepreneurship is considered a driver of the progressive economy, but in developing countries compared to developed nations, it is questionable whether the pedagogy of entrepreneurship education derivates entrepreneurs who can independently implement viable business ideas while having theoretical knowledge (Polin and Golla, 2016). The emergence of neuroscientific techniques through experimental application research entrepreneurial skills, mindset and behaviors (Krueger and Welpe, 2014). Entrepreneurial education through neuroscientific techniques is grounded across all levels of teaching and learning that can produce productive and successful entrepreneurs (Krueger and Welpe, 2014).

Neuroentrepreneurship is a novel research field where many developed countries invest human capital to study emerging mental health challenges and their pivotal role in policy implementation (Korpysa, 2020). The study of entrepreneurship is a multifaceted science that is impacted by many viewpoints and complex intervening factors. Psychology of entrepreneurship uses cognitive and behavioral sciences to examine entrepreneurial behavior (Heydari et al., 2020). Cognitive science examines heuristic ideas and the entrepreneurial mindset, to pinpoint cognitive processes that facilitate quicker and more efficient decision-making (Zaro et al., 2016). An individual with an entrepreneurial mindset can produce value by identifying and seizing opportunities, making decisions with incomplete information, and maintaining flexibility and resilience in sometimes complex and difficult circumstances (Daspit et al., 2023).

Recently we have witnessed a notable expansion in the effort to understand the elements that lead to entrepreneurial success, as demonstrated by an increase in scholarly research, publications, and a booming business consultancy sector serving entrepreneurs (Liguori et al., 2024). Although studies acknowledge that a

management mindset and an entrepreneurial mindset (EM) are complementary, they also stress that shifting from one to the other might result in a long-term competitive advantage (Wright et al., 2000). Behavioral analysis strongly emphasises how decisions are made about the competence and conduct of the entrepreneur. Entrepreneurial conduct is shaped by traits including dynamism, leadership, capacity for taking risks, adaptability, and internal drive various forms of entrepreneurial opportunities—creative, exploratory, allocative, and imitation—are facilitated by these attributes. Organizational characteristics like innovation, development, and expansion are also considered while examining entrepreneurship (Cao et al., 2022).

Evolution of the Concept

The emerging field of neuroentrepreneurship education combines cognitive neuroscience and entrepreneurial education (Korpysa, 2020). Electroencephalogram (EEG), Functional Magnetic Resonance Imaging (FMRI), eye tracking, and Galvanic Skin Response are a few of the cognitive neuroscience tools used to investigate the neural underpinnings of entrepreneurial decision-making (Alvino et al., 2020). Researchers present the idea of neuroentrepreneurship and make the case for applying neuroscience to the study of entrepreneurial processes (Korpysa, 2020).

A pictorial summary of the evolution of neuroentrepreneurship is derived through cognitive neuro-science techniques with sub-branches of entrepreneurial education with cognitive science and behavioral science. The Figure1 depicts the interdisciplinary approach of entrepreneurship. The study of Zaro et al., (2016) used cognitive brain mapping (CMB), a quantitative research tool, with EEG readings. EEG recordings were made while fourteen male participants—both seasoned business owners and non-entrepreneurs—made decisions. Information flow across brain areas was analyzed using entropy correlation calculations, which shed light on

the cognitive processes related to entrepreneurship. The small sample size of the study was justified, emphasizing the possibility of important findings in neuroscience research with participant-level consistency in brain activation patterns (Zaro et al., 2016). By using the cerebral mapping technique, network structures related to entrepreneurial decision-making may be analyzed by creating Cognitive Brain Maps, which were created by computing entropy values.

The study of Massaro et al.'s (2023) FMRI approach uses a variety of experimental designs to measure the traits of entrepreneurs. Under the assumption of a "pure insertion" of cognitive processes, cognitive subtraction compares brain activity in response to various tasks. Rather than depending solely on pure insertion, cognitive conjunction evaluates common brain regions between various stages of the cognitive process. By treating the variable of interest as continuous, parametric design examines correlations between changes in the variable and alterations in brain activity. Functional integration models hold promise for comprehending social cognition, leadership dynamics, and entrepreneurship by examining how distinct brain regions interact with one another during activities or in resting-state contexts.

Kaminskiene et al. (2023) explain eye-tracking methodology for research on entrepreneurship education was employed in this study. After a literature search produced 505 papers, 105 of them were deemed relevant. Eye-tracking systems measured pupil size, fixations, and saccades from lab to mobile to provide insights into learning processes and attention distribution in controlled or uncontrolled environments. By considering the viewpoints of both teachers and students, the approach improves on established qualitative and quantitative methodologies in entrepreneurship education research.

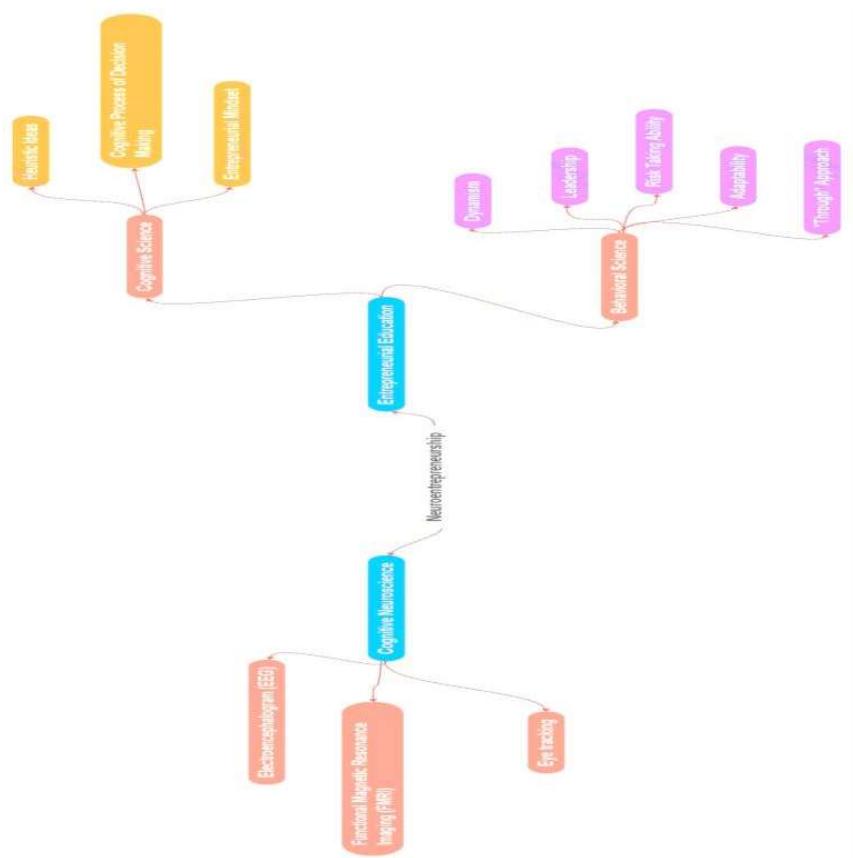


Figure 01: The breakdown mind map of neuroentrepreneurship

Source: Author Compiled

“Through” Approach to Entrepreneurial Education”

The study's stated research problem concerns the dearth of investigation and incorporation of neuroscientific methods as a "through" approach in the context of entrepreneurship education in Asian countries. Even if the heterodox view of entrepreneurship has historically placed more emphasis on behavioral and psychological aspects, new developments in neuroscience provide a revolutionary way to understand the thoughts and actions of entrepreneurs (Alvino et al., 2020). According to the study, there is a theoretical and practical gap in developing a new

paradigm for entrepreneurial education since there is a lack of engagement with neuroscientific methodologies in entrepreneurship education in developing Asian countries.

According to (Cucino et al., 2021), Asian nations are falling behind in introducing neuroscientific methods into entrepreneurial education. Most of today's instructional strategies follow conventional wisdom, ignoring the potential advantages neuroscientific understandings might offer in better comprehending and developing an entrepreneurial attitude and behavior. A substantial knowledge gap is created by the paucity of research in this field, making it more difficult to understand how neuroscientific methods might be used in local entrepreneurship education (Boldureanu et al., 2020).

The study shows that there is a knowledge and empirical gap in Asian entrepreneurship education when it comes to the application of neuroscientific techniques with experimental methodologies. The lack of experimental applications, including transcranial magnetic stimulations (TMS) and control tasks like the BART risk-taking game, limits the investigation of brain and psychological behaviors necessary for a comprehensive understanding of neuroentrepreneurship (Clements et al., 2021). The research pressure highlights the need for a paradigm change in Asian countries' entrepreneurship education systems. In order to promote a holistic entrepreneurial attitude, the traditional "about" or "for" approaches must give way to a more dynamic and practical "through" approach that incorporates neuroscientific strategies from the educational level (Alvino et al., 2020).

The research issue that has been found has consequences for academics and policymakers in Asian nations; a more efficient and comprehensive paradigm can be developed by addressing the gap in the theoretical and practical applications of neuroscientific tools in entrepreneurship education (Boldureanu et al., 2020). To

foster entrepreneurial skills, mentality, and behavior that are in line with the changing business and innovation landscape of the twenty-first century, it is imperative that this paradigm shift be made (Kuratko, 2009; Sharma et al., 2021).

Research Objectives

The overall objective of this study is to systematically investigate, analyze, and propose a comprehensive framework for the integration and application of neuroscientific methods as a "through" approach in entrepreneurship education within Asian countries instead of an "about" or "for" approach with a specific focus on addressing the identified gaps in the context of developing countries in the Asian region. The aim is to bridge the theoretical and practical divide by developing a new paradigm that leverages neuroscientific insights to enhance the understanding and cultivation of entrepreneurial attitudes and behaviors.

Provide insights into the implications of addressing the theoretical and practical gaps in neuroentrepreneurship education for both academia and policymakers in Asian developing countries. Emphasize the potential benefits of a paradigm shift for fostering entrepreneurial skills, mentality, and behavior aligned with the evolving business and innovation landscape. The study aims to contribute to advancing neuroentrepreneurship education by offering practical recommendations and a holistic framework that addresses the identified gaps and supports the development of a more effective and relevant educational paradigm in Asian countries.

Theorizing the concept of entrepreneurship

According to Korpysa (2020), an entrepreneur's search for opportunities is driven by brain impulses, with the left hemisphere supporting conscious thought and the right hemisphere supporting intuition and creativity. Despite some criticism,

researchers support the use of cognitive neuroscience in entrepreneurship, highlighting the importance of neuroentrepreneurship in revealing the neural basis of decision-making, taking risks, and adapting to entrepreneurial ventures. However, this field is still at the ground level with the dearth of studies (Korpysa, 2020). Over the years, the study of entrepreneurship has changed, examining the phenomena from various angles and using interdisciplinary techniques (Girişken and Çakar, 2021). The neuroentrepreneurship field has emerged due to increased interest in the relationship between neurology and entrepreneurship in recent years (Girişken and Çakar, 2021). The application of neuroscience technologies to financial, organizational behavior, and consumer research is discussed in the article; this has led to the emergence of subfields like neuromarketing and neuromanagement (Girişken and Çakar, 2021). The observed variations in people's propensity for entrepreneurship, neuroentrepreneurship focuses on comprehending the conscious and unconscious mechanisms that determine entrepreneurial behavior (Girişken and Çakar, 2021). While acknowledging the dearth of research on this emerging topic, the study highlights its promise to offer new insights into the psychological, emotional, and cognitive aspects of entrepreneurial decision-making (Girişken and Çakar, 2021).

The variations in brain activity between entrepreneurs and non-entrepreneurs are examined in various research in the literature on neuroentrepreneurship utilizing various neuroscientific techniques. Successful entrepreneurs use both hot (emotional thinking) and cool (logical analysis) cognition, according to Lawrence et al. (2008). Neural activity is regulated by the frontal lobes but occurs in multiple parts of the brain. Stanton et al. (2008) used neuroeconomics methods to investigate whether entrepreneurs' decisions are reasonable. Similar to risk-takers, entrepreneurs had increased dopamine receptor density in their brains, according to Zald et al. (2008). By highlighting various brain reactions to risk as shown by FMRI data.

Entrepreneurial cognition is described as the cognitive structures that inform assessments, judgments, and decisions in opportunity evaluation and venture formation (Heydari et al. (2020)). It draws on the literature on social cognition and cognitive psychology to understand the mental processes behind entrepreneurial activity. According to Heydari et al. (2020), the author suggests three important elements for the growth of the field of neuro-entrepreneurship: rejecting the computational theory of the brain, emphasizing outcomes like mirror neurons, empathy, semantic simulation, dopamine system, and habits, and replacing the conventional Turing machine with new tools.

PRISMA Review

The mental processes that underpin entrepreneurial learning, investigating purpose, convictions, and more complex knowledge systems (Heydari et al., 2020). It emphasizes the value of technical proficiency, cross-disciplinary cooperation, and an awareness of perceptions, causes, and effects. According to Heydari et al. (2020), it presents a model of temporal, neurological, and cognitive space and implies that studying cognitive processes at many levels is necessary to comprehend entrepreneurial behavior. Simon (1999) is credited as being the first to examine three levels of analysis related to the phenomena of cognition: the external level, which reveals what we say and do; the internal level, which examines attitudes, beliefs, and intentions; and the crucial stage of the deep level of neurological levels, which examines the biological process (Heydari et al., 2020). In recent times, there has been a noteworthy upsurge in worldwide research on entrepreneurship across diverse fields, acknowledging the crucial function of entrepreneurship in the financial and societal development of countries (Shane, 2000; Davidsson, 2016). The complex effects of entrepreneurship go beyond market innovation and economic growth to include creating jobs, which raises employment levels (Shane,

2000). Due to the increased emphasis being paid to the pedagogy of entrepreneurship and the formation of an entrepreneurial spirit through education, entrepreneurship education has been continuously improving (Kuratko, 2009). To better understand the factors that influence entrepreneurial behavior, researchers have conducted studies in various industries and regions using survey analysis, experiments, and interviews (Mustafa et al., 2016; Al-Jubari et al., 2019).

Paper Retrieval

Turulja et al.'s (2020) research on entrepreneurial ambitions and informal support showed that family and friends significantly influenced entrepreneurial goals. Similarly, Wegner et al. (2019) used the theory of entrepreneurial promotion approach to show a strong correlation between entrepreneurial education and intent. Studies on environmental factors conducted by Lopes et al. (2020) revealed that students in urban areas had stronger entrepreneurial inclinations than students in small cities (Rasool et al., 2021). According to a comparative study conducted in developing nations, students in large cities show more positive entrepreneurial ambitions and a better predisposition towards starting creative enterprises (Rasool et al., 2021).

After a review of research publications, the relationship between neurology and entrepreneurship was shown to be intrinsic, making neuroentrepreneurship a fresh and hitherto unexplored field of study. Research has examined the practical implications of neuroentrepreneurship in management and entrepreneurship through coupling and co-citation analyses, despite the difficulties in expressing its theoretical and practical contributions (Cucino et al., 2021). Presenting a thorough manual for business owners and researchers interested in neuroentrepreneurship research, the study highlights the necessity of discussing the common approaches and trends underpinning this field of study. The research utilizes bibliometric techniques,

namely VOS viewer, to visualize the outcomes of the literature analysis and comprehend research patterns in literature knowledge networks (Van Eck and Waltman, 2010).

Understanding a researcher's paper publishing trends, citation status, author network analysis, and co-citation are made easier with the use of bibliometrics as a measurement method (Lin and Yan, 2016; Hsu and Chiang, 2017; Liang and Liu, 2018; Su et al., 2020; Jia et al., 2022). A more thorough grasp of study patterns is made possible by using visual co-citation analysis, which facilitates data interpretation and the discovery of internal linkages between data (Ma and Xi, 1992). With its insights into important studies, co-citation networks, research trends, and methodologies, this study provides an invaluable resource for navigating the rapidly developing field of neuroentrepreneurship research (Kakouris and Georgiadis, 2016; Zhou et al., 2018; Yi and Gao, 2021).

The brain is fundamental to the human experience; it controls our ideas, feelings, and behaviors and shapes how we see the world (Tracey and Schluppeck, 2014). Even if the brain plays a crucial role, our understanding of its complex functions has historically lagged, especially in the field of entrepreneurship study (De Holan, 2014). Scholars studying entrepreneurship are fascinated by the workings of the mind, but their understanding of mental processes is limited by insufficient instruments. Instead of attempting to explain how and why entrepreneurs think the way they do, the emphasis is typically placed on the traits and behaviors of entrepreneurs (Mitchell et al., 2002; Shane, 2000; Mitchell et al., 2005).

The working definition of nascent entrepreneurship is an individual alone or with the support of others, undertaking efforts to start a new venture. Entrepreneurial mindset is a creative cognitive ability to derive entrepreneurial behaviors and innovative applications. There has been a profusion of educational courses and

practical workshops focused on teaching the required skills and information for creating and executing new company ideas. This is a direct outcome of the notion of "Entrepreneurship" gaining major importance in the discourse of global business as well as the local context of the business. According to Neck and Greene (2011), these entrepreneurship programs aim to provide professionals with the necessary fundamental skills to turn creative ideas into profitable company operations. To convert a new idea into a new creation by managing the potential risks. 'Entrepreneurship' is regarded as a significant instrument for developing abilities in creative areas required by firm founders, which is why it is accorded a great deal of significance in academics, as stated by policymakers and academic experts.

Fayolle (2008) and Kriby (2007) contend that despite the growing availability of educational courses based on entrepreneurship, there is a continuous dispute regarding the scope of these programs, the aims they are designed to achieve, and the tactics utilized. The existing corpus of research admits that the influence of entrepreneurship education has been typified by outcomes that are contradictory to one another for the most part. The bulk of the research that has been undertaken on the effect of students' entrepreneurial intention shows that it has a positive impact (Kuttim et al., 2014). Some writers have studied the influence of undergraduates' entrepreneurial intention in existing literature. However, some research implies that there is no discernible beneficial influence on the entrepreneurial intention of undergraduate students (Huber, 2014). According to Bennett (2006) and Mwasalwiba (2010), the existing study fails to provide adequate evidence to draw a conclusive judgment on how the training techniques that are currently in use influence the growth of a new entrepreneur. The existing research is inadequate to build a consensus in favor of active ways such as case studies, group discussions, and business simulations (Bennett, 2006; Mwasalwiba, 2010). In addition, a dearth of research has been conducted to support active approaches. However, most of the

research could not come up with a better conclusion on leading factors of potential entrepreneurs of undergraduates.

There is a recognized redesigned teaching technique that is detailed in the plan for nascent entrepreneurship. This method is based on the existing body of research that has been conducted on fledgling entrepreneurship. According to Mwasalwiba (2010), high-study institutions are limited by the high cost, time-consuming nature, and divergence from ordinary university teaching practices of conventional approaches. They are also hampered by the fact that these approaches are expensive. On the other hand, Osterwalder and Pigneur (2010) presented innovative approaches to encourage the growth of prospective company owners. One example is using a business model canvas combined with the lean start-up movement. In addition, while the design thinking (DT) method is widely recognized as a potentially fruitful approach, there is currently a dearth of evidence that it successfully fosters an entrepreneurial mindset among students.

This research focuses on the further review of the ongoing discussion on the potential entrepreneurship from the educational background by examining the contribution of the factors of entrepreneurial motivation, entrepreneurial self-efficacy, and personal difficulties to the formation of a nascent entrepreneurial mindset. As mentioned by Fayolle et al. (2006), the nascent entrepreneurial mindset is the main important and critical leading factor of realistic entrepreneurial behavior which is identified as perspective and readiness for entrepreneurial activities engagement. In this realistic entrepreneurial behavior, the main affecting factor is the self-efficacy of the potential entrepreneurs, which is utilizing the intention and confidence level of the entrepreneurs (Fayolle et al., 2006). As per the deep discussion of Renko et al. (2021), investigations of potential entrepreneurship are

motivated by one of the main dynamic factors identified as self-efficacy exciting challenges against the crucial mindset of entrepreneurship.

Neuroscience and its Advancement with Entrepreneurial Cognition

The existing studies on neuroscience recently broke the existing myths on neuroscience related to entrepreneurship by bringing a new perspective to examine entrepreneurial behavior and entrepreneurial cognitions. In general, entrepreneurs generate new ideas as the initial stage of becoming an entrepreneur and then convert the idea into a profitable enterprise. Though it seems like a general process, there is a deep cognitive process behind it. According to Shane, Locke, and Collins (2003), getting the hidden advantage of new opportunities through a transformation process of an idea into a business in the cognitive application. Therefore, each new enterprise raised today is raised with the deep cognitive process, and this new enterprise establishment starts with the initial step of the brainstorming session on the ideas to create a product or service with the identification of the potential of the business and its resources (Baron, 2007). In the discussion of entrepreneurship, the entrepreneur's creativity is one of the important characteristics of generating ideas with massive amounts of information from several aspects and converting them into profitable business creation. All of these are based on the creative through a cognitive structure. This concept is easily discussed in cognitive science and shows how a person's creativity makes a new product or service profitable (Baron, 2006). Baron (2006) argues cognitive science is a pattern recognition study exploring the meaningful occurrence or change. According to the findings of Baron & Ensley (2006), the novel pattern, as well as the new business opportunities, are identified by the people who have a strong cognitive framework and the opportunity recognition well linked with the cognitive process to improve the dedication of entrepreneurial mindset (Baron, 2006).

Paradigm Shift of Neuro entrepreneurship

A significant method for identifying embryonic entrepreneurs is establishing a venture via an in-depth business environment evaluation. Specifically, it originates from the well-structured framework that Mitchell et al. (2002) defined as being associated with entrepreneurial cognition. The entrepreneurship founded in cognitive philosophy and social cognition serves as a framework of knowledge. Using that reasoning, Santos et al. (2010) strengthen that argument by highlighting, via their study, the importance of neuro-entrepreneurship research in the context of entrepreneurship. Neuroentrepreneurship is a well-structured and informed framework characterized by key features such as mirror neurons, empathy, reproduction semantics, the dopamine system, and social behaviors. As of 2010, Blair, E. In addition, the studies that are now being conducted are giving data to demonstrate that the entrepreneurial learning that undergraduate students get directly influences the mindsets of aspiring entrepreneurs. Potential entrepreneurs can identify existing possibilities with the assistance of their creative thinking that is based on positive emotions. Based on the characteristics of the opportunities, they can generate lucrative ideas and then turn those ideas into business execution (Liu et al.,2022).

Methodology

A qualitative research method is used to elicit existing knowledge on the paradigm shift of neuroentrepreneurship. The methodology consists of a systematic review PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework employed in this review, as in Figure 03. Articles were selected according to the PRISMA framework with the application of the Ryyan Systematic Review tool. There were 161 articles identified from the databases then, and 60 were removed because of duplicate records, ineligible by automation, and other reasons.

Then, at the screening stage, 40 articles were excluded, and 20 were not retrieved; therefore, 41 were reported for eligibility. However, 26 reports were excluded because of not primary research and were unavailable for analysis. Therefore, 15 articles have been included under the inclusion criteria for critical review. PRISMA Annexure 01 is enacted in the annexure.

The data analysis uses the Ryyan tool and consists of fifteen key literatures. These articles were critically reviewed by two collaborators and a reviewer. The key components of the article, such as the research title, keywords, author name, and abstract, were considered in the systematic review analysis focusing on the variables; Neuro-entrepreneurship education, paradigm shift and neuro-scientific techniques. Based on the reviewer's inclusion and exclusion criteria decision along with their comments, and with the decision of Ryyan automation in terms of selecting the most relevant articles in the analysis, an overall results zip file was downloaded from the Ryyan tool, which provided a clear picture of the articles in the analysis. Google Scholar, Semantic Scholar, and Microsoft academic search engines were used to search the articles. These articles were used to create an Excel dataset along with all the key components in the research before the Ryyan process proceeded. After developing the dataset and all the components, a CSV file was converted from the Excel file, and it was uploaded to Ryyan for analysis. Article selection and reviewed decisions are finalized through the Boolean operators in the Ryyan tool.

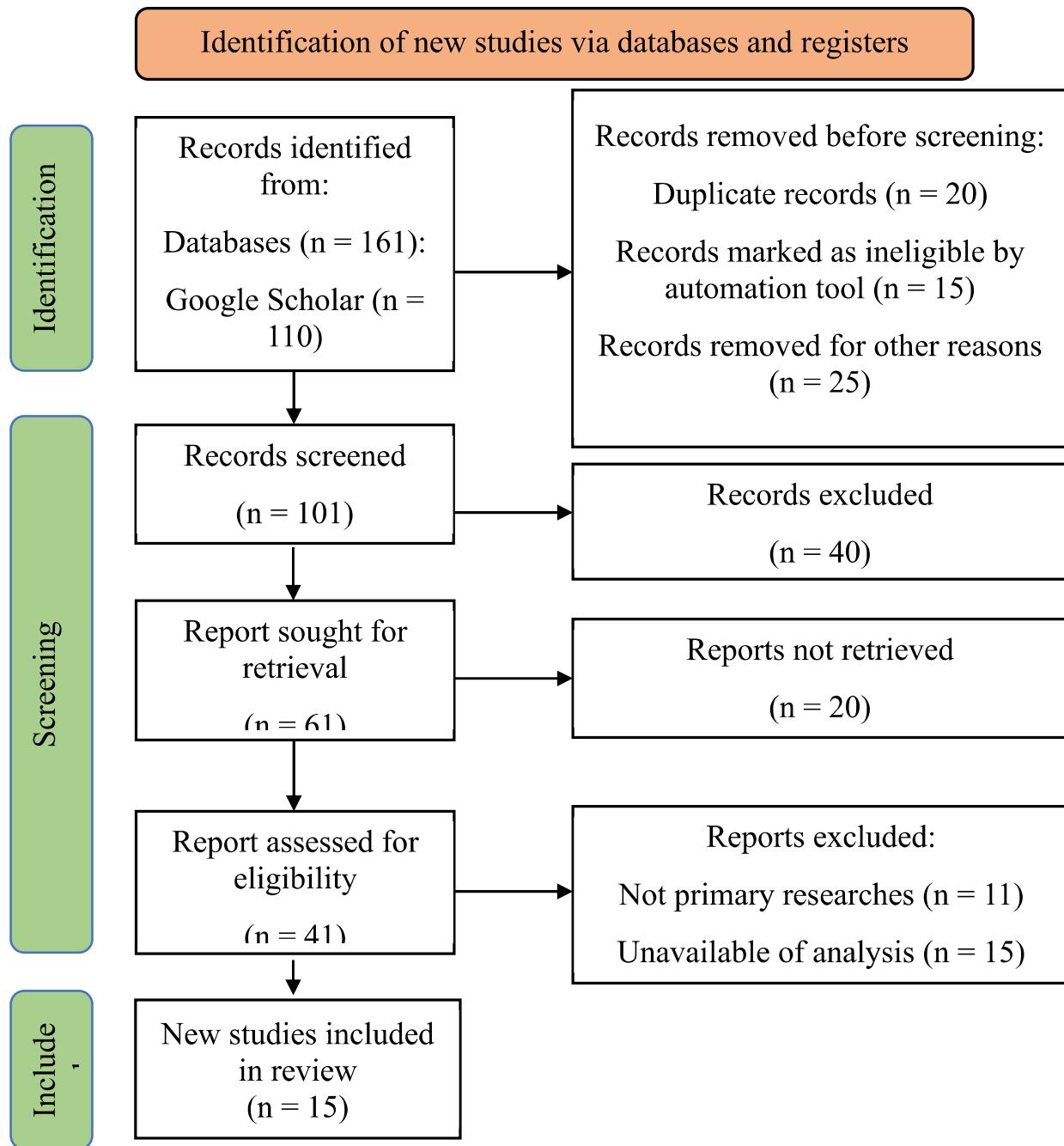


Figure 03: PRISMA (Preferred Reporting Items for Systematic Reviews) framework

Source: Author Compiled

The key 15 articles were produced after several stages of inclusion and exclusion criteria performed by the reviewers and the AI Ryyan tool. These articles have been identified as the best-suited papers to address the study's research question. AI Ryyan employs titles, abstracts, keywords, citations, and references to present user-friendly information to the literary work. AI Ryyan functions as a tool to document and manage the review process; screening and coding, Note-taking and automation, and report generation. Ryyan tool uses various principles from literary presentation and information documentation to enhance the efficiency and organization of the systematic review process. The analysis of AI Ryyan identifies and filters articles, extracts data, and creates reports using machine learning. Reviewers interpret and decode the data, guaranteeing that human knowledge is kept at the centre of the procedure. AI Ryyan uses a combination of machine learning and human input to expedite research reviews. While it helps with searching, screening, data extraction, and reporting, users are still in charge and can still exercise critical thought.

Figure 04: Results generated by Ryyan tool

The screenshot shows the Ryyan software interface. On the left, there is a sidebar with various filtering options:

- Possible Duplicates
- Inclusion decisions:
 - Undecided: 0
 - Maybe: 11
 - Included: 14
 - Excluded: 9
 - Conflict: 32
- Decision by:
 - Mr. Isuru Samaranayake
 - Mr. Mithu Mithu
 - Tashil Fernando
- Minimum collaborator decisions:
 - At least 1: 61
 - At least 2: 61
 - At least 3: 40
- Maximum collaborator decisions:
 - At most 0: 0
 - At most 1: 0
 - At most 2: 21
- Search methods [Add new]:
 - Uploaded References [Main.cs...]: 10
 - Uploaded References [Main.cs...]: 10
 - Unuploaded References [csv.maj...]: 20
 - Unuploaded References [csv.maj...]: 2
 - Uploaded References [Main.cs...]: 17
 - Unuploaded References [Main.cs...]: 7
- Keywords for include [Add new]:

The main area displays the search results for "2024-01-19: Systematic Review on - A New paradigm shift of neuroentrepreneurship in Sri Lanka". It shows 61 unique entries, with the first few listed below:

Date	Title	Authors	Rating
2020-01-01	Isuru, mithu, Tashil Neuroentrepreneurship a new paradigm in the managem... Korpsyra, J		
2021-01-01	Isuru, mithu, Tashil What Is Neuroentrepreneurship?The Theoretical Framew... Giritken, A.; Çakar, T		
2020-01-01	100% Isuru, mithu, Tashil Entrepreneurial Cognition and effect on Neuro entrepre... Heydarl, M., Xiaohu, Z., Sael...		
2021-01-01	Isuru, mithu, Tashil Assessing the Perceived Value of Neuroethics Questions ... Moss, A.U., Li, Z.R.; Rommel...		
2022-01-01	Isuru, mithu, Tashil Integration of Neuroscience and Entrepreneurship: A Sy... Liu, W., Xu, Y., Xu, T., Ye, Z.,...		
2014-01-01	Isuru, mithu, Tashil It's all in your head: Why we need neuroentrepreneurship De Holan, P.M.,		
2020-01-01	Isuru, mithu, Tashil exfactor of organizational innovation Neuroentrepreneurship: ... Lanitz, N.,		
2014-01-01	Isuru, mithu, Tashil Neuroentrepreneurship: what can entrepreneurship lea... Krueger, N.; Welpe, I		

At the bottom, there is a detailed view of an article titled "Assessing the Perceived Value of Neuroethics Questions and Policy to Neuro-Entrepreneurs". The abstract discusses the implications of neuroscience on ethical issues and the role of neuroethics in addressing them.

Source: Ryyan Tool

Collaborators and one reviewer are engaged in the Ryyan tool in deciding articles' inclusion and exclusion criteria. The Ryyan tool also automatically excluded irrelevant articles under the main root of our study, considering all key components of the research article with the CSV file. Then, the Final inclusion decision was exported from Ryyan to identify the key articles to be considered under the review.

Findings

According to the currently available information, a successful entrepreneur combines emotional thinking and intellectual analysis. When it comes to emotional cognition, the cognitive process and pattern of the brain are most focused on creativity, which is an essential quality for an entrepreneur to possess. When it comes to people who are enthusiastic about starting their own business, inventive thinking is the most important factor in achieving success. From a different point of view, having a logical and analytical mentality enables entrepreneurs to think logically and effectively manage risks when they are beginning a new firm. The development of critical and tactical entrepreneurship is even more vital than the mastery of the art of successful entrepreneurship, which is one of the most important aspects of entrepreneurship. Within the context of this situation, neuroscientific approaches are advantageous because they contribute to the enhancement of the critical decision-making skills of successful entrepreneurs, which ultimately leads to the development of critical entrepreneurs. The psychological, emotional, and cognitive components are the three primary features that are contained simultaneously.

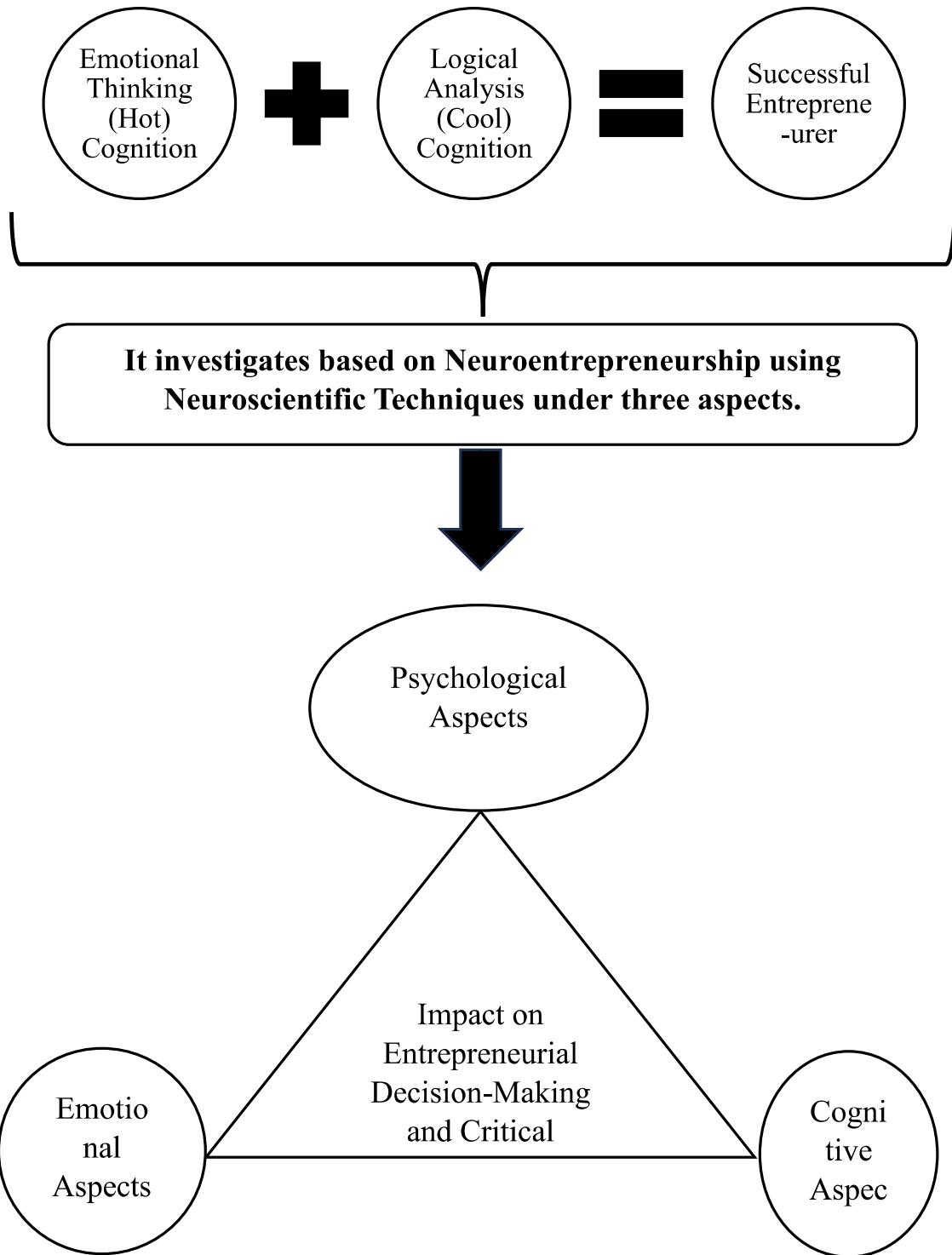


Figure 05: The visualization of the transformation of successful entrepreneurship into neuroentrepreneurship through neuroscience

Source: Author Compiled

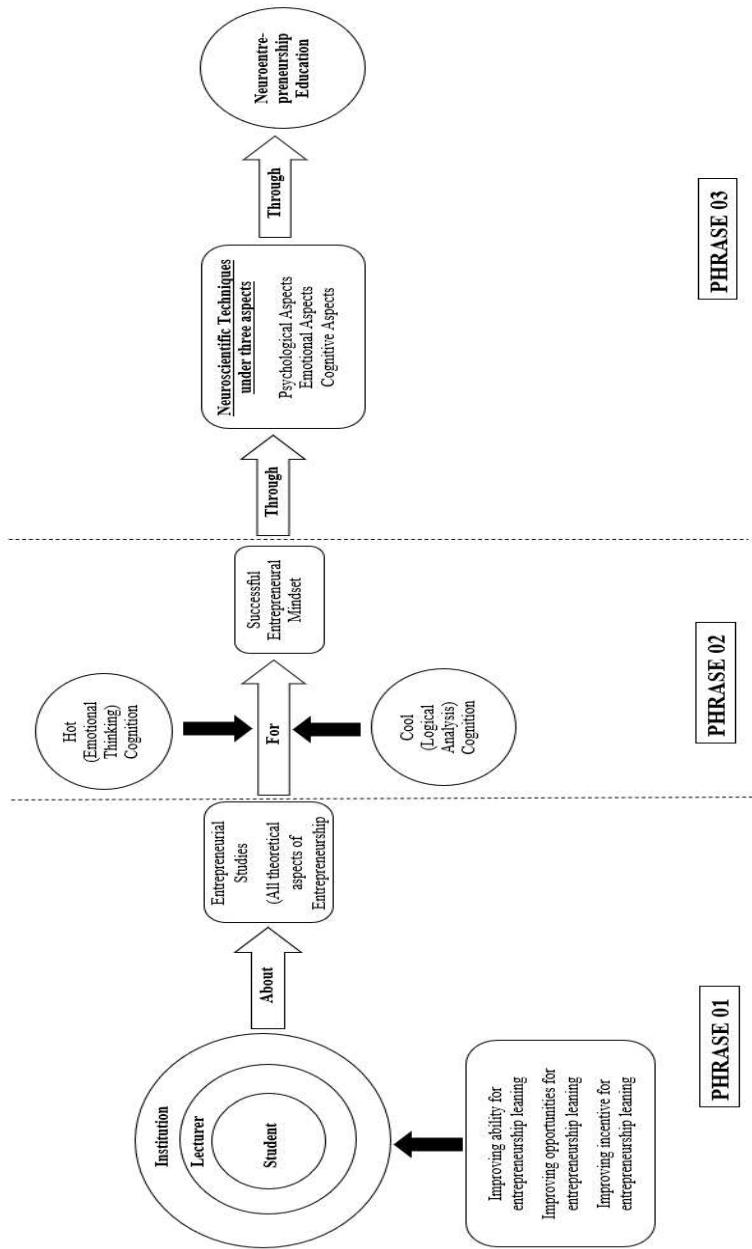


Figure 06: Proposed Entrepreneurial Education Framework for Neuro-entrepreneurship.

Source: Author Compiled

The pedagogy of entrepreneurial education is shown in Figure 06, especially within the university system, which consists of three levels, starting from the institution at the first level, lecturers at the second level, and finally, a student-centred phase. Along these, all the levels are influenced by improving the ability for entrepreneurship learning, improving opportunities for entrepreneurship learning and improving incentives for entrepreneurship learning. These improving dimensions tend to be explained with the “about” approach, which emphasizes theoretical education and it’s a traditional way of doing entrepreneurship education. This is a phase where the traditional way of entrepreneurial education has taken place in Asian countries.

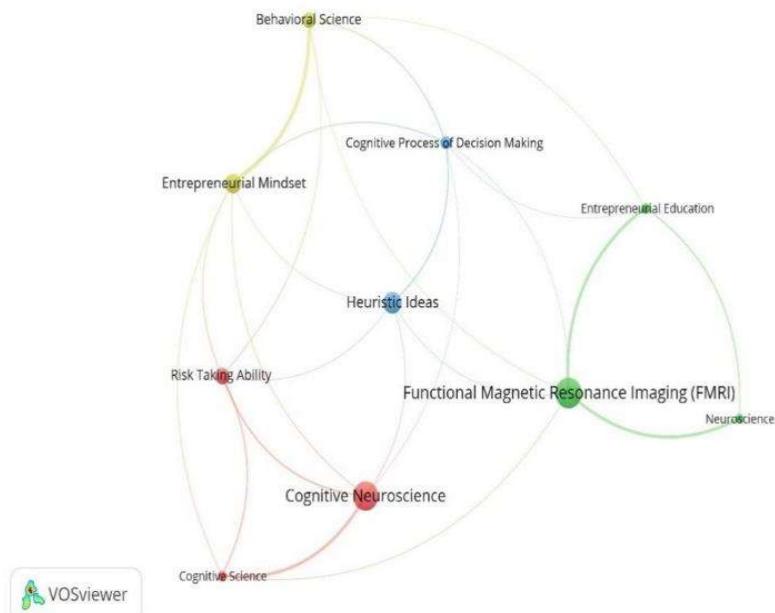
The study also emphasizes how important neuroscientific tools like ERP, FMRI, EEG, and eye tracking are to study entrepreneurship. It highlights the value of experimental methods and how they can improve entrepreneurial theory and create causal relationships. The conclusion highlights the need for continued research into the complexities of entrepreneurial cognition and acknowledges that as neuroscience-related studies proliferate, so does the chance for prospective business owners to broaden their understanding of entrepreneurial thought. This research presents neuroentrepreneurship as a workable strategy for developing a holistic entrepreneurial mindset in Asian nations, calling for a paradigm shift in entrepreneurship education.

For those who aspire to become entrepreneurs, the importance of incorporating neuroscientific techniques into schooling is stressed. An increasingly sophisticated knowledge of entrepreneurship is facilitated by insights into decision-making procedures, risk-taking behavior, and entrepreneurial mindset. According to the study, understanding the brain's role as a micro-antecedent of human behavior and

decision-making is crucial for aspiring business owners to successfully negotiate the challenges of the entrepreneurial journey.

Discussions

This VOSviewer network map explains the two main clusters of neuroentrepreneurship education: cognitive neuroscience and entrepreneurship education. The two main clusters hold the main factors influencing the connection between respective variables with the main clusters. Electroencephalogram (EEG), Functional Magnetic Resonance Imaging (fMRI) and eye tracking are classified under cognitive neuroscience. Further, behavioral science and cognitive science are classified under entrepreneurial education. Cognitive science categories are heuristic ideas, cognitive processes of decision-making, and entrepreneurial mindset. Behavioral science consists of dynamism, leadership, risk-taking ability, adaptability and “through approach”. It has been summarized through a PRISMA review of the existing literatures. The contribution is to precisely explain the key factors that derive neuroentrepreneurship. A framework of neuroentrepreneurship evolution as a first time visualized and conceptualized through a critical analyzes of key articles.



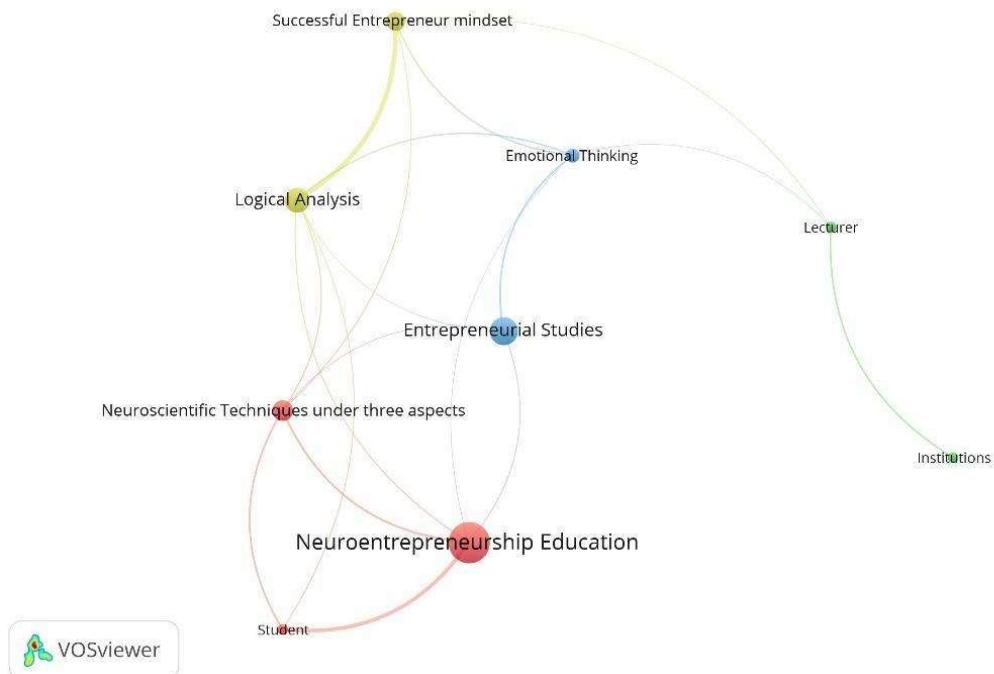


Figure 08: Neuroentrepreneurship Education Clusters

Source: Author Compiled

Recent trend emphasizes the student-centric approach is evident and viable to create an entrepreneurial mindset through neuroscientific techniques in entrepreneurial education. As is clearly emphasized in the framework of this study above, applying interdisciplinary aspects in entrepreneurial education at all levels, from institution to students highly expected to practically implement this model. This study contributes to developing new theories and models to bring about a new paradigm shift in Asian countries' entrepreneurial education system by applying neuroentrepreneurship.

Conclusions

The revolutionary potential of integrating neuroscience into entrepreneurship education is highlighted by this study's result on neuroentrepreneurship education in

Asian nations. The findings highlight the importance of interdisciplinary collaboration by revealing a strong relationship between brain correlates, entrepreneurial behavior, and mentality. To separate particular features of entrepreneurial behaviors, the study supports the incorporation of behavioral experimental applications like transcranial magnetic stimulations.

Neuroentrepreneurship has a significant effect on prospective university entrepreneurs. It clarifies the cognitive factors affecting decision-making and emphasizes the significance of neuroplasticity and emotional intelligence. In addition to providing a thorough understanding of cerebral hemispheres and fostering multidisciplinary insights for a comprehensive understanding of entrepreneurship, the study promotes a change towards a neuroscientific perspective.

The study of Ghina et al. (2017) moves away from the “about” and “for” approach to the “through” approach. With the base theoretical model, A new framework is developed along with other key dimensions and neuro-scientific techniques as a “through” approach. While moving to the second phase, it’s about the “for” approach. We emphasise the practical application of entrepreneurial theories in the context of the real world, which supports creating a successful entrepreneurial mindset. hot emotional thinking, known as “hot cognition, refers to decision-making and cognitive processes that are impacted by emotions. This is in contrast to “cool cognition”, which is more analytical, logical, and reasonable thinking that is not greatly influenced by emotional intelligence. The third phase is a crucial cluster emphasize the application of neuroscientific techniques under three aspects: psychological aspects, emotional aspects, and cognitive aspects.

Psychological aspects refer to the mental process and behavior contributing to an individual’s thoughts, feelings and actions. Techniques like FMRI, EEG, and MEG

are applied to study emerging entrepreneurial education. Emotional aspects refer to subjective experience, expressions, and the regulation of emotions, using FMRI, Positron Emission Tomography (PET), and Heart Rate Variability (HRV) monitoring to apply in this neuroentrepreneurship. Cognitive aspects involve mental processes.

such as perception, attention, memory, language, problem-solving and decision making, where it capitalizes the FMRI, Event Related Potentials (ERPs), and TMS. An approach of "through", then "for" or "about", which is a pedagogy of education, revolutionized with the experimental application of Neuroentrepreneurship education.

In Conclusion, the education system that is now in place in developing Asian nations is one of the most important aspects that contribute to the fact that such countries are still considered to be developing Asian countries. According to the material shown before, the primary reason for this is how entrepreneurship education is provided. To produce a prospective entrepreneur via the education available in entrepreneurship, it is not sufficient to simply acquire knowledge about what entrepreneurship is and the requirements of the trip that is required for entrepreneurship. The literature asserts that this "for" and "about" approach to entrepreneurship education will result in students and future entrepreneurs who can pass the test with excellent marks rather than becoming actual entrepreneurs. This is the primary rationale for this assertion. Consequently, this review research aims to concentrate on the 'through' approach of entrepreneurial education to produce a genuine entrepreneur. The institutes should follow the human cognition process-based education with several real business scenario experiments of maintaining a business with new ideas and taking risks. Further, appropriate brain training programmes should be implemented into the education system to improve the

cognitive process of average human beings so that they can become critical human entrepreneurs.

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Annexures

Annexure 01: PRISMA output generated by Ryyan tool

Stage	Number of Articles Identified	Number of Articles Screened	Number of Articles Eligible	Number of Articles Included
Initial Database Search	161	141	126	101
Duplicates Removed	20			
Removed for other Reason	25			
Titles and Abstracts Screened		101	61	41
Articles Excluded (with reasons)			Not primary researches: 11, unavailable of analysis: 15,	

Articles included in review			15	15
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Annexure 02: Reviewed articles

Title	Authors	Journal	Year	Abstract	Keywords
Individual Neuromarke	Ranasinghe, Millagala, Surangi, H.	Journal of Management Marketing and Logistics Available at SSRN 4519936. SAGE Open	2019	Purpose - This research	Entrepreneurship
The Impact of Entrepreneurial Risk Aversion on Firm Performance	Pérez-Cenís, Kaffka, G., Heydari, M.	Brain-Driven Entrepreneurship Research Revista Turismo Estudos e Práticas-RTEP/UERN	2023	This research	Neuromarketing
The Impact of Entrepreneurial Risk Aversion on Firm Performance	Surangi, H., Pérez-Cenís, Kaffka, G., Heydari, M.	SAGE Open Brain-Driven Entrepreneurship Research Revista Turismo Estudos e Práticas-RTEP/UERN	2022	The area of female entrepreneurship	Entrepreneurship
The Impact of Entrepreneurial Risk Aversion on Firm Performance	Surangi, H., Pérez-Cenís, Kaffka, G., Heydari, M.	Journal of Management Marketing and Logistics Available at SSRN 4519936. SAGE Open Brain-Driven Entrepreneurship Research Revista Turismo Estudos e Práticas-RTEP/UERN	2018	The adverse effects of entrepreneurial intent	Entrepreneurship
Entrepreneurial Cognition: A Review	McMullen, Didenko, A.	Handbook of entrepreneurial cognition European Proceedings of Social and Behavioural Sciences.	2014	By offering an alternative	Entrepreneurship
The Impact of Entrepreneurial Risk Aversion on Firm Performance	Caliendo, Baluku, M.	Journal of Economic Behavior & Organization Journal of Entrepreneurship and Innovation in Emerging Economies	2021	Our research	Balloon Approach
Risk aversion and firm performance: An empirical study	Baluku, M.	Journal of Entrepreneurship and Innovation in Emerging Economies	2010	Risk attitude	entrepreneurship
The Cognitive Style of Entrepreneurs	Denis Greening, Swinging a Balloon Around	Journal of Management Studies Journal of business venturing	2021	Extant research has c	Despite its many achieve
Swinging a Balloon Around: The Cognitive Style of Entrepreneurs	Bradley, S.	Journal of Management Studies Journal of business venturing	2011	Resource slack represents	entrepreneurship
. Entrepreneurial Cognition: A Review	Oliver, A., Joshi, P.S.	Anales de Psicología/Annals of Psychology Neuron,	2022	Culture may influence	Entrepreneurship
View from the Inside: The Impact of Technological Change on Entrepreneurial Cognition			2016	In this era of technolog	